VII. *On the Structure of the Skull in the Chameleons.*

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[Plates XV.–XIX.]

Besides specimens in my collection of full-grown Chameleons of the common kind and one of the dwarf kind (*C. pumilus*), I received, some years since, a new-born young one of the common species from my friend Mr. T. J. Moore, of Liverpool.

This gave me an opportunity of comparing an early condition of this strangely formed skull with its permanent form; and the comparison of the two stages gave me the most unexpected results: I found that the conception I had formed of the high, posterior part of the skull, by comparison of it with the same parts in other Lizards, was as wrong as could well be, and that my interpretation of these *coalesced* and highly modified parts was worth as much as all guesswork is worth, viz. worse than nothing.

Having found my "key," I shall use it carefully in opening the meaning of this, the most singular of all skulls. I shall describe the adult skull first, being confident now of its true meaning; and of it I shall take the outworks first and the inner building afterwards. Then the skull of the young will be described, and its conformity and nonconformity to other and more typical kinds of Lacertilian skulls shown.

After that the dwarf kind will yield its less aberrant skull, to show that there is nothing absolutely unchangeable in any type of skull, but that the more striking modifications of structure are mobile as it were, and are always ready to oscillate this way and that towards other morphological types and patterns.

Nothing is easier than to speak glibly of generalized types and of types that are specialized; in practice, however, no such facility is possible. Here is a family of Lizards whose whole construction is special and aberrant to a marvellous and almost unique degree; and yet these very types are the most archaic, the lowest, and the most generalized, in many respects, of all the known Lacertilia.

So much so is this the case, that every zoologist or anatomist describing the Lizards, as a group, and giving their zoological and morphological characters, would have to qualify one half of his description by repeatedly saying, "except in the Chameleons."

I have long ago shown how remarkably this type differs from the other Lizards in its

shoulder-girdle and sternum ("Shoulder-girdle and Sternum," plate xi. figs. 4–6, p. 122); and I have no doubt that every part of its organization, if well worked out, would show some very important modifications.

But in the culminating types of any group whatever, some archaic characters are sure to crop up. I find this "survival" in the Frog among the Anura, and in the Nimble and Green Lizards among the Lacertilia: in the former, which is the best pattern-form for the group, there are two or three characters that are exceptional; and in the latter, the most refined and delicate forms in the Lizard group, the whole cranial roof, from snout to occiput, might have been directly, and not remotely, derived from some most ancient Ganoid fish (see "On the Skull of the Lacertilia," Phil. Trans. 1879, part ii. plate 42, p. 597).

Skull of the Adult Chameleon (*Chamæleo vulgaris*).

Seen from above, or below, the outline of this skull is a long oval; from the side it is seen to have a short, steep face, almost as steep and short as that of a Tortoise, and to be surmounted behind by an exorbitant three-limbed crest; it has huge eye-sockets, and a steep hinder region.

In this species, and still more in other larger and more bizarre kinds, the marginal bones of the skull-roof are very large, crested, and adorned with knobs and prickles, as though it were showing a *Selachian atavism*, and had compounded its investing bones out of the shagreen prickles and the ossified skin of some such Placoid forefather.

The roof dips; and the frontal is not seen from the side; and the whole upper outline, looked at from above (Plate XVI. fig. 3), is like the plan of a double arch, with the coronal suture as a common basal line. But the keystone in front, the single premaxillary (*px*), is wedged in between the fore face below and the fore skull above. The hinder keystone, the interparietal (*i.p*), binds and finishes the arch that springs from the great auditory wings (Plate XVI. fig. 4). The lower edge of the fore part of the skull spreads out into a much broader structure than the upper; its margins are the maxillaries (*mx*); the upper outline of the fore part is formed by the prefrontals (*p.f*) (superficial or dermal ethmoids). The middle of the upper margin is formed by the postorbitals (*pt.o*); and the form is finished behind by a pair of *compound* bones, the squamoso-parietals (*sq. p.*). Thus the single *adult* frontal (*f*) is completely enclosed, and forms the centre of the somewhat sunken roof, which is finished behind by the base of the huge crested interparietal (*i.p*).

The lower surface shows a broad latticework, very complex, and very *compound*; it is composed of subcutaneous plates and of submucous bones (that are ectostoses in lower types), of cartilage, and of cartilage-bones; for in this view we see the basis cranii, the complex palate, and the marginal bones of the face. The side view (fig. 1) shows the steepness of the face, the height of the crest behind, the strength of the flat jaws,

the depth of the mandibular pier, and the size of the eye-sockets, with their membrano-cartilaginous partition.

The end view (fig. 4) shows an almost vertical structure, semioval in shape, which is the frame of a system of openings or archways. In the centre we see the foramen magnum (*f.m*) on each side; above, the huge temporal openings; directly below, the archway under the skull and between the steep pterygoids (*pg*); and outside those bones a steep oblique space, whose outer boundary is the high vertical quadrate or mandibular pier; this outer space, on each side, is again subdivided by the transit of the long descending columella auris.

A. *The Investing Bones.*

This remarkable building must now be taken to pieces (ideally), and described part by part.

The frontals (*f*) are completely fused together, and form a broad plate over the fore part of the cranial cavity. The coronal suture is nearly transverse; and in front of it, contrary to rule, in a hollow surrounded by tubercles, we see the round fontanelle (*fo*). Each side of the bone is cut away in a concave manner four times; and the fore part is a sharp spike wedged in between the nasals.

Those bones (*n*) are small and falciform, with their sharp ends, behind, binding on the last shallow pair of notches on the frontal. In front a sharp spike of bone, the nasal process of the premaxillary (*n. px*), wedges in between these broad ends, and almost touches the frontal wedge.

The margins are formed above, half by the prefrontals (*p.f*) and half by the so-called postfrontals ("postorbitals" *pt.o*). Each prefrontal is an irregular plate of bone, high-crested and arched; it encircles the front third of the huge orbit, and runs inwards as an anteorbital plate behind the nasal capsule. Above, it articulates by sutures with two of the shallow notches of the frontal; it is then itself notched in a crescentic manner, leaving an oval membranous space between it and the narrow part of the corresponding nasal; its narrowed fore part binds, first upon the broad end of the nasal, and then upon the nasal process of the premaxillary. In front (fig. 1) it reaches down to articulate with the maxillary (*mx*) above the nasal opening (*al. n, e. n*); and behind it articulates with the postorbital (*pt.o*) over the middle of the orbit. The suture at this part is jagged or dentate; and both the bones being narrowed where they meet, a triangular part of the frontal (*f*) appears in the roof of the orbit.

The fenestra between the nasal and prefrontal (*n., p.f*) is directly over the *continuous* aliseptal roof; here the fenestra is in the bony investment; in *Lacerta* that roof is complete, but the cartilaginous capsule is imperfect, there being a nasal fenestra in the proximal part of the aliseptal cartilage on each side ("Skull of Lacertilia," part i. Phil. Trans. 1879, pl. xliii. fig. 7, p. 607). The next bone, the postorbital (*pt.o*), has its fore half binding against the roof (*f, i.p*), and its hinder half projecting outside and beyond it,

and reaching round the great temporal space to articulate with the squamosal (*sq*). It has a sharp, crested, ornate upper part, which passes, hollow and flat, to the roof; then it descends as a long, subtriangular spike behind the orbit, which spike binds on the front of the upturned malar or jugal bone (*j*). Where it articulates with the prefrontal, there it shows an orbital part articulating with the frontal over the eyeball. The squamosal (*sq*) is a very sharp bone: but it appears to be larger than it is; for the ascending part, which runs up to the interparietal crest, is half of it due to another bone, and the suture can be faintly seen even in the adult (fig. 1, *sq*, *p*). That other bone is a subarcuate thickish rod, all that remains of the parietal. From the point of fusion downwards the squamosal enlarges and forks, one fork passing forwards to articulate, by a long sinuous suture, with the postorbital, and the other behind a round arched space; under this archway the anterior canal and its ampulla (*a. s. c*) can be seen. The hind fork descends as a straight process to articulate with the "otic process" of the quadrate (*q*, *ot. p*). On the other side of the archway the squamosal sets its fore foot upon the thick top of the jugal (*j*). The inner face of the hinder fork does not directly bind upon the parotic wings (fig. 4, *op*, *sq*), but there is another temporal bone (*s.t*) wedged in between those two parts: this is a wedge-shaped bone, sharp above and thick below; it reaches halfway to the parietal above, and nearly down to the quadrate below.

The interparietal (*i.p*) forms the broad hinder third of the roof, behind the coronal suture, which is slightly concave in front; the wings of this T-shaped bone articulate obliquely with the broadest part of the huge postorbital (*pt.o*); and then each wing of the bone ends by a gently concave margin which overroofs the occipital arch (*s.o*) From the tubercular growths that surround the fontanelle (*fo*) in the hollow of this hind part of the frontal, the interparietal arises (covered there with tubercles) into a huge, flat, falcate, free crest, whose convex margin is above, and the concave margin of which, at its proximal third, rests directly upon a crest that grows upwards from the supraoccipital (figs. 1 and 4, *i.p*, *s.o*). At its highest part, behind, it is thickened and knobbed, and is embraced by the top part of the parietals (*p*), which expand somewhat to articulate with its double thickening. Below and behind it is a rather thin lamina; and for some depth the supraoccipital (*s.o*) is as thin as the plate which rests upon it.

The upper view (fig. 3) shows to what an extent the hinder part of *the three parietals* (*i.p*, *p*) have shot up out of the reach of the cranial cavity, *relatively lessened* to a tithe of its original bulk (see Plate XV.); and now these bones mainly enclose the largely open temporal space right and left; in the young we see them lying down upon the great fontanelle of the tumid cranium. Here the huge temporal space is bounded by the interparietal within, and by the postorbital and combined squamosal and parietal outside.

Seen from below or above, the infero-lateral series of bones are like a Gothic arch; the key-stone of this arch is formed by the premaxillary (*p.x*), which is a wedge

with a rounded lower end and a sharp thin upper part—the nasal process (*n. px*). Only the broad end is seen in the lower view; for the maxillaries (*mx*) close under it, as they close under the paired rudiments in the human embryo! This wedge is thickened again, above (fig. 3), where it binds together the two prefrontals; it then runs sharp and thin between the nasals. The maxillaries (*mx*) are large bones, high in front, and gently lessened backwards into a sharp jugal process. In front they have a deep round notch, in which the outer nostril and its enclosing cartilages (*e.n*, *al.n*) lie. In front each bone is not far from its fellow, and is ornate; behind the nostril the bone rises as a strong rounded process, which props up the prefrontal. Descending thence in a crescentic manner, it leaves a space for the small oblong lacrymal (fig. 1, *l*), inside which is seen the large triangular lacrymal canal (*l. c*), bounded on its inside by the anteorbital plate of the prefrontal.

Only the maxillary (above) bears teeth; and these are confluent with the jaw. From the lacrymal the jugal (*j*) runs back, no larger than it at first; but bending up behind at more than a right angle, it becomes a broad and thick bar, finishing the orbit, propping up the fore fork of the squamosal, and is itself clamped in front by the styloid lower crus of the postorbital.

The lower surface of the skull (fig. 2) shows the maxillary as having a wide palatine plate up to its junction with the palatine bone (*pa*); thence it becomes less than half its anterior width. Behind the junction of the maxillaries in front, in the semi-oval space formed by their divergence, we see the single vomer (*v*); its length is one half greater than its breadth; its sides are concave; and so is its inferior surface: it projects into the notch between the maxillaries; and the palatines articulate with its posterior margin, which is a rounded notch. It is a thick but not very high bone (Plate XVIII. figs. 2–5).

The ascending processes of the palatine bones (fig. 2, *pa*) are united together by suture for a greater length than that of the vomer; together these upper arched spurs are not equal to the lower flat region of these bones.

The lower part of each palatine grows outwards and forwards, and articulates obliquely with the palatine plate of the maxillary; behind, the inner margin of each bone, at the lower plane, approaches the mid line; and thus a grooved space is formed, into which both the internal nostrils (choanæ, *i. n*) open. These passages are large, oval, with their long axis parallel to the axis of the skull, and their inner boundary the notched tract between the lower and upper part of the palatines. In front of and outside each inner nostril there is a membranous space, bounded on its inside by the vomer, and on its outside by the palatine process of the maxillary. Above this space, and above the vomer, there is in most Lizards, as in the Serpents, a thin curled laminar bone—the "septo-maxillary;" it does not exist in the Chameleon.

Where the broad lower part of each palatine articulates with the pterygoid (*pg*),

behind the co-adapted upper spurs, the base of the cartilaginous orbital septum (*p.s*, *p.e*) is seen, with a widening membranous space on each side of it as the pterygoids diverge backwards. These bones (fig. 2, *pg*) are one half longer than the palatines, and they pass obliquely inside these bones, and then send out a triangular spur close behind the suture. Then they seem to lessen to one half their front width; but this is due to a change in the direction of the expanded part from horizontal to vertical.

Their hinder part is the broader by far, and is a large reniform lobe (fig. 1), which is lowest opposite the ascending jugal bone (*j*), and then rises to be attached by ligament to the quadrate (*q*). Instead of passing within that bone, it comes short of it by a definite space. Behind the sinuous inner margin of the flat part, the pterygoid has an oblique facet of cartilage, which lies obliquely over and outside a similar facet on the "basi-pterygoid" (*b.pg.*). Attached to the outer spur of the pterygoid, and wedged between it and the jugal process of the maxillary, is a four-cornered oblique plate of bone, one third the size of the palatine; this is the "transpalatine" (*t.pa*). This bone forms, with the pterygoid, the hind boundary of a large oval palatine fenestra, the outer wall of which is formed by the maxillary and the inner by the palatine.

The investing bones of the lower jaw (Plate XVI. fig. 1, and Plate XVII. fig. 1) are a dense well-compacted series of splints. The dentary (*d*) is much the largest of these, and occupies nearly all the outer face of the jaw and carries all the teeth; it is seen, above and below, on the inner side. On the outside, within and behind the dentary, the articulare (*ar*) is invested with the angulare (*ag*), a small style; the supra-angulare (*s.ag*), is a wider plate, which overlaps the jaw and is seen most on the inner side (Plate XVII. fig. 1). On the inner side, in turn overlapping the supra-angulare, we see the large four-cornered coronoid (*cr*), whose upper angle forms the crest or coronoid part of the jaw; it bends down upon the supra-angulare behind, the articulare below, and the dentary and splenial in front. The latter bone (Plate XVII. fig. 1, *sp*) is a thin lath of bone, widest in front, where it reaches the chin, and narrowest behind; it hides the upper edge of Meckel's cartilage (*mk*).

B. *The Endocranium.*

The inner part of the skull is composed of membrane, cartilage, and bone; the hind part is largely ossified, but keeps most of the subdividing synchondroses. The fore part is cartilaginous, with subcentral calcifications running in certain lines between the orbits; the ethmoidal and nasal regions are free even from this deposit (Plate XVII. figs. 1–4). In front of the postcranial roof there is a long pyriform fontanelle; and the tract between the eye and ear is largely membranous. This arises from the arrest of the alisphenoid (*al.s*); the orbitosphenoidal tracts are very narrow, and become mere lips to the orbital septum, only spreading again in the *cribriform region*, where the olfactory

nerves (I) pierce the narrow floor of this shallow part of the skull, where it is closing in above the fore end of the orbital septum.

The rest is a broad, subquadrate, inflated, double pouch, forming the paired nasal capsules (Plate XVII. figs. 3 & 4).

The occipital condyle (*oc. c*) is semicircular, and receives into its substance the exoccipitals and basioccipital; the notochordal "dimple" is obsolete; its upper edge (Plate XVI. fig. 4) is straight, and its lower more than half a circle. This condyle is nearly twice as large as the foramen magnum (*f. m*) above it—a small gothic archway. The basioccipital (*b.o*) is a large bony wedge, convex behind, at its narrow part, but hollowed in front, where it joins the basisphenoid (Plate XVI. figs. 2–4, *b.o*); its cranial surface is slightly concave.

Standing on this bone, right and left, we see the exoccipitals (*e.o*): but these are not simple now (Plate XVI. fig, 4, *e.o*, *op*, & Plate XVII. fig. 4); they have coalesced with the extended opisthotics. Hence they seem not only to give exit to the 9th, 10th, and 12th nerves (IX, X, XII), but also to contain the lower and hinder part of the posterior and horizontal canals, and to form the large solid parotic wings (*op*).

The supraoccipital (*s.o*) is also compound; for it has gained two additional bones, the epiotics, and therefore encloses the anterior and posterior canals (*a. s. c*, *p. s. c*) at their junction. It forms the upper half of the foramen magnum (*f. m*), rises high up above that passage, and then, suddenly narrowing, forms a crest—that, at its narrow top, on which the interparietal (*i.p*) rests. This occipital "tegmen" runs as far forward as to the alisphenoid (Plate XVII. figs. 1, 3, 4, *al.s*); it is wedge-shaped laterally, and emarginate above (Plate XVII. fig. 1 & 4., *s.o*). In front (Plate XVII. fig. 4, *s.o*, *ep*) this epiotico-supraoccipital ends in five tooth-like projections, the middle of which is the crest, whilst the outer two are part of the original epiotic. On account of the curious manner in which the hind roof is, so to speak, tilted forwards, the epiotic rides obliquely over the top of the prootic (Plate XVII. figs. 1, 3, *ep*, *pro*).

The prootics (Plate XVI. fig. 1, and Plate XVII. figs. 1, 3–6, *pro*) contain most of the anterior and horizontal canals (*a. s. c*, *h. s. c*); they lie below the epiotic region of the compound roof-bone (*ep*, *s.o*); and the two eminences caused by the ampullæ of those canals are close behind the foramen ovale (Plate XVII. figs. 3, 4, V). On the inside of the skull (Plate XVII. fig. 1, *pr. o*) the prootic is seen in front of the triradiate synchondrosis, in the fork of which we see the epiotic (*ep*), and behind the stem the opisthotic (*op*).

In the upper view (Plate XVII. fig. 4) the anterior and posterior canals (*a. s. c*, *p. s. c*) are seen projecting from the prootics and opisthotics, and meeting in the epiotic to unite into one tube; the horizontal canal is *beneath* the anterior, and is therefore out of sight in this aspect (see fig. 6, *h. s. c*) In the inner view the prootic is seen to rest, behind, on the basioccipital (*b.o*), although it mainly lies on the basisphenoid (*b.s*; see also the section, Plate XVIII. fig. 12, *b.s*, *pr.o*). The meatus internus (Plate XVII. fig. 1, VIII)

is seen a little distance behind the foramen ovale (v); the 9th and 10th nerves (ix, x) escape between the opisthotic and exoccipital, the chink between these ankylosed bones being large on the inside; the 12th nerve (Plate XVI. fig. 4, xii) pierces the exoccipital.

The basisphenoid is a large winged bone; below (Plate XVI. fig. 2, *bs*), it is seen to be split behind, and to have its hind margin somewhat concave to receive the rounded fore edge of the basioccipital (*b.o*). It narrows forwards, is hollow both above and below (Plate XVIII. figs. 11 & 12); and in front the part below the pituitary cup (Plate XVII. fig. 1, *py*, *b.s*) is no thicker than the base of the orbital septum, the end of which it ossifies. That cup, the "sella turcica" (*py*), has a thick bottom; and its hinder margin is the oblique forwardly-tilted postclinoid wall (*p.cl*). On each side of this hollow the bone grows out as a large oblique expanding wing—the basipterygoid process (*b.pg*), the direction of which is forwards, outwards, and downwards (Plate XVI. figs. 2, 4, Plate XVII. fig. 3, and Plate XVIII. figs. 11 & 12, *b.pg*). These wings have a facet on their enlarged free ends; and these articulate with the facets of the pterygoid, the basipterygoid processes lying between and below the pterygoid bones. The alisphenoid (Plate XVII. figs. 1, 3, 4, *al.s*) arises from the prepituitary part of the basisphenoid: it is a thickish semiosseous band, filling up scarcely a quarter of the alisphenoidal region; the rest is membranous. It is free and pointed above, the point looking forwards in the membranous space. We miss here the latticework of cartilage seen in the smaller and more typical Lizards (see Phil. Trans. 1879, pl. 43), both in the alisphenoidal and orbito-sphenoidal region. The Chameleon's alisphenoid is ossified in its lower half; and at its root and in its upper falciform part it is calcified more or less, as in other Lacertilia.

A large rounded space of membrane intervenes between the orbito-alisphenoid (Plate XVII. figs. 1–3, *o.s*, *al.s*). This is not bounded by cartilage, but the roof-bone comes down to this part and rests on these cartilaginous wings. This is where the upper part of the huge postorbital (*pt.o*) wedges in over the orbit, behind the orbital plate of the frontal (Plate XVI. fig. 1); the latter plate rests on the orbito-sphenoid, and the postorbital on the interparietal, near its junction with the frontal. In old specimens (Plate XVII. fig. 3, *p.s*, *o.s*) the presphenoid becomes osseous; this tract leans against the ossified part of the alisphenoid, and descends at a right angle to that bar; the cartilage is continuous between them. In the angle the large round optic fenestra (ii) is seen; and in front of the presphenoid there is an oval fenestra twice the size of the optic passage; this is the interorbital space (*i.o.f*); it is a long *notch* in the Lizard (*op. cit.* pl. 43. fig. 8, *i.o.n*). Endosteal tracts are to be traced, in old specimens, under the optic passage and under and over the interorbital fenestra, up to the point where the middle wall belongs to the ethmoid (*p.e*). From the basisphenoid to the anteorbital cartilage the basal line is slightly arched or concave; the upper line is still more concave (Plate XVII. fig. 3).

In the upper view of the endocranium (Plate XVII. fig. 4), the orbito-sphenoidal

wings (*o.s*) are seen to be only one third as wide behind as the alisphenoids (*al.s*); they become only half their hinder width, and then expand again as they pass into the ali-ethmoidal laminæ (*al.e*), where the *floor* of the skull passes into the *roof* of the nasal pouches.

Near each other, in the middle of this rewidened tract, the small oblique olfactory passages I are seen; and further forwards, under these wings, the orbito-nasal nerves (figs. 3 & 4, v′) enter the nasal labyrinth. Where the middle ethmoid passes into the septum nasi (Plate XVII. fig. 1, *p.e*, *s. n*), there is no "cranio-facial fenestra," as in *Lacerta* (op. cit. pl. 43. figs. 1 & 2, *c.f.f*) and *Trachydosaurus*, but, as in the Struthionidæ among Birds, the orbito-nasal partition is continuous, except in the presphenoidal region.

The valley over the ethmoidal wings has no ascending (tegminal) bar of cartilage growing over it either here or in *Lacerta*; but all Birds show a spike-shaped remnant of the front cranial roof of the "Ichthyopsida" mounting over the channel for the olfactory nerves. The endocranial roof, however, is very large behind in the Chameleon, as I have just shown.

The nasal labyrinth, as seen from above (Plate XVII. fig. 4), looks like a quadricellular capsule. It has four nearly equal swellings: the hinder pair are circular; and the front pair have a helicoid appearance. The postero-lateral edge, in front of the ali-ethmoidal laminæ (*al.e*) is sinuously notched; and in the notch are packed, right and left, the nasal glands (*n. g*). This is the position of these glands in certain birds where they are moderately developed, as the Rhea and Fowl (Phil. Trans. 1866, pl. 9. fig. 5, *n. g*, and 1869, pl. 86. fig. 9, *n. g*). In Snakes and most Lizards, where the vomers are distinct, these glands lie in the vomers as in a dish, and are covered by a lid-like bone—the septo-maxillary (Phil. Trans. 1878, pl. 33, and 1879, pl. 42. *v*, *n. g*, *s.mx*).

Here, in the Chameleon, the high (supero-posterior) position of these glands is the correlate (as in the Fowl), of a single vomer, and of suppression of the septo-maxillaries. There is no more than a broad lip-like prenasal cartilage (Plate XVII. figs. 1, 3, & 4, *p.n*), slightly bent downwards in front. Outside, in front, the outer nostrils (*e. n*) are nearly encircled by a confluent labial (*al.n*) or alinasal cartilage, nearly closed above, and very similar to the cartilaginous "annulus tympanicus" of the Frog. In the anteorbital region the nasal labyrinth is complicated by an ethmo-palatine cartilage (Plate XVII. fig. 3, and Plate XVIII. figs. 6 & 6A, *e.pa*).

Endocranium as seen in transverse sections.

Here the various sections throw a welcome light upon the structure of the nasal labyrinth (Plate XVII. fig. 2, and Plate XVIII. figs. 2–6A).

In the side view of the septum nasi the cartilage is seen to be thickened at the ends and middle of the septum; and the part removed to expose this structure (Plate XVII. fig. 2) shows that the pouch on each side is subdivided into two, and that each of these

is a double pouch. The front division opens outwards as the outer nostril, and the hinder into the inner nostril, outside the ascending submesial process of the palatine bone (see also Plate XVI. fig. 2, *pa*, *i. n*).

In the transverse sections through and in front of the outer nostril (Plate XVIII. figs. 2–5), we see how the cornua trabeculæ (*c. tr*) form the dilated floor, and that to these horns are added the growths of the annular alinasal (*al.n*).

Directly behind the nostrils (fig. 5) the septum nasi (*s. n*) is seen to be definitely rounded below, a form which it keeps as it passes backwards as the septum also of the orbits (the perpendicular ethmoid and presphenoid—*p.e*, *p.s*).

At the widest part of the nasal pouch, through the middle of the hinder division, we see that the aliseptal cartilage (Plate XVIII. figs. 6 & 6A, *al.sp*) becomes both wall and floor (*n. w*, *n.f*) as well as roof. The floor is dilated where it presses against the intruded upper palatine process (*pa*) on each side; and near this part the cartilage grows inwards so as to form a semicircle (half a coil) with the outer part of the floor; this half-coil is the "inferior turbinal" (*i. tb*). Where the wall turns inwards, below, to form the floor, there, on the outside, a large pedate process of cartilage grows downwards and inwards; this is the ethmo-palatine cartilage (*e.pa*), which generally becomes confluent with the nasal pouch even in the Urodela; it is very large in the Chameleon.

Behind the nasal pouches and the hinder part of the ethmoidal roof the perpendicular ethmoid (Plate XVIII. fig. 7, *al.e*, *p. e*) is still no deeper than the septum nasi (fig. 6, *s. n*); but it is much thicker, and the top of it is grooved, and in the groove run the olfactory nerves (I). The next section (fig. 8) shows a similar structure; but in front of the interorbital fenestra the cartilage, now presphenoid (fig. 9, *p.s*), is of considerable depth and is becoming thin in the middle. The next section (fig. 10) is through the common optic foramen (II.); and now the cranial cavity is suddenly widened to receive the fore part of the hemispheres.

The next two sections (figs. 11 & 12) are through the alisphenoidal region, and where the mid brain lies; the cavity of the skull is here at its widest. The first of them is close in front of, and the next directly behind, the "sella turcica." In the first (fig. 11) the alisphenoids (*al.s*) are cut through where they are seen to rest on the basisphenoid (*b.s*), which is deeply scooped above for the pituitary body (*py*), and below shows the beginning of the basipterygoid wings (*b.pg*).

The partly ossified anterior part of the supraoccipital (*s.o*) is shown in the next section (fig. 12); here the sides are membranous, and through a hole in this large fenestra, below, the trigeminal nerve (V.) is seen emerging. The prootic (*pro*) passes forward under the foramen ovale, and articulates with the broader part of the basisphenoid (*b.s*), which is subconcave above and winged below (*b.pg*).

In the next section (Plate XVII. fig. 5) the supraoccipital (*s.o*) is seen as a thickish vertical plate under the interparietal (*i.p*); the notch between this part and the epiotic (*ep*) is cut through (see figs. 1, 3, & 4). Here the arch of the anterior canal (*a. s.c*)

is cut through in the epiotic, and the arch of the horizontal canal (*h. s.c*) is cut through in the prootic (*pr. o*). That bone extends outwards, and flanks the "paroccipital," or wing of the combined opisthotic and exoccipital (fig. 4, *pr. o*, *op*). The vestibule (*vb*) is laid open in this section, and the passage into it, viz. the fenestra ovalis (*f. o*), close in front of the columella. Below this opening a wedge of bone is seen: this is the antero-inferior part of the opisthotic (*op*); see also fig. 1. Here the section of the cranial cavity is hourglass-shaped, the auditory capsule bulging inwards; the stem of the triradiate synchondrosis, between the three periotic elements, is here cut through downwards, and the cartilage of the anterior fork, between the epiotic and prootic, is cut across. The 4-edged wedge of bone belonging to the opisthotic (*op*) rests obliquely upon the edge of the fore part of the basioccipital (*b.o*), which is at its broadest here: it is gently concave above, and much more scooped below (see also Plate XVI. fig. 4, *b.o*). In the next section (Plate XVII. fig. 6), the epiotic and supraoccipital (*ep*, *s.o*) are continuous, and are of great extent (see also figs. 1, 3, 4); the spinous process is thinner, and passes gradually into the roof (*s.o*), which also passes into the epiotic (*ep*). This region contains the neck of the anterior canal (*a. s.c*) where it is passing into that of the posterior canal. The horizontal canal (*h. s.c*) is seen in section in the prootic (*pr. o*); and the vestibule (*vb*) is shown opening out at the fenestra ovalis (*f.o*). Here the stapedial end of the columella (*st*) is seen filling up the opening, and the rest of the columella (*m.st*, *e.st*) is shown attached to the inside of the quadrate, which is cut through obliquely, showing the pedicle (*pd*) and the shoulder of this pier (*q*). The investing bones over this part are not figured. Here a thin wedge of the opisthotic (*op*) is cut through; this is the part which in *higher* Lacertilia divides the *fenestra ovalis* from the *fenestra rotunda*. At this part the opisthotic is distinct from the exoccipital; this latter bone (*e.o*) is here shown as helping to form the passage for the 9th and 10th nerves (IX, X). The basioccipital (*b.o*) is here at its narrowest part, close in front of the occipital condyle.

The next section (Plate XVII. fig. 7) is through the root of the condyle, the thickest part of the parotic process (*op*), and the hind part of the quadrate (*q*), behind the columella. The posterior canal (*p. s.c*) is here cut through; and here the ridged roof-piece (*s.o*, *ep*) is very solid. The vestibule (*vb*) is still seen behind the fenestra ovalis: this is the part of the sac which corresponds to the more distinct rudiment of the cochlea, seen in the higher kinds of Reptilia (including most Lizards). The vestibular sac here intervenes between the exoccipital (*e.o*) and the opisthotic (*op*), which has here its most solid and outstanding part, forming most of the "parotic process." The basioccipital (*b.o*) has here widened again somewhat before its end in the substance of the condyle. This section is behind the prootic and the two front canals; the quadrate (*q*) is cut down from the otic process (*ot. p*) to its lower condyle (*q. c*). The cartilage on the inner face of the auditory sac is the hinder fork of the triradiate tract (see fig. 1).

On the Investing Bones displayed in the transversely-vertical sections.

By going over the figures of these sections in detail, we shall recapitulate what has been said of this system of bones; the reader will compare these illustrations with those showing the skull in various aspects.

Section 1 (Plate XVIII. fig. 1).—This is through the fore part of the skull, and shows how the maxillaries (*mx*) embrace the premaxillary (*px*), especially below; besides the sharp dentary edges of the former, the upper part of each bone has begun to form the large supracranial valley.

Section 2.—Here (fig. 2), in front of the outer nostrils (*e. n*), the maxillaries (*mx*) are scooped in forming the passage, and are two-winged; they are crested above, have a ridge below the crest, and are cultrate at their inturned lower edge. The premaxillary (*n. px*) is now a small wedge between the upper part, only, of the two bones, above the end of the nasal pouches. Below, an oblique wedge of bone is seen; this is the large left fork of the vomer (*v*) cut through.

Section 3.—Here (fig. 3) the skull was divided through the nostrils (*e. n*); and thus the maxillaries (*mx*) are seen in two parts on each side. The premaxillary (*n. px*) has thickened again; and the right, or lesser, fork of the vomer (*v*) is cut through as well as the larger spur.

Section 4.—In this section (fig. 4), which is also through the nostrils (*e. n*), the nasals (*n*) are cut through at their foremost pointed end; the other parts are closely like what was shown in the last.

Section 5.—Here (fig. 5), close behind the nostrils, the vomer is cut through behind its notched part; it is hollow both above and below, and much wider in the latter region. There is here a definite space between the vomer and the inner edge of each maxillary bone (*mx*); and the nasal and intermaxillary wedges (*n*, *n.px*) are larger.

Section 6.—In this section (fig. 6) two pairs of new bones are cut through; it was made through the widest part of the hinder pouches. The cranial trough is now very large and deep; for above the maxillaries (*mx*) a pair of large, solid, obliquely-crested bones have come into view. These are the prefrontals (*p.f*). The sharp wedges of the nasals and premaxillaries (*n*, *n. px*) only cover the middle part of the nasal roof (*al.sp*); there is here only a fibrous mat (*n. f*) over the nasal sacs, right and left. Below, the vomer has given place to the upper processes of the palatines (*pa*), which are thick styles: the maxillaries are here thick slabs of bone, sharp above, subcultrate below, and having a sharp process running inwards, the rudiment of a palatine plate. Between the wall and this partial floor the ethmo-palatine (*e.pa*) is lodged, just as the "pro-rhinal" is lodged between the laminæ of the premaxillary in a Batrachian.

Section 7.—This slice (fig. 7) is from behind the nasal pouches, and also behind the nasals and premaxillaries. Here the frontal (*f*) comes in at the mid line, and it forms the keystone to a low inverted arch, the piers of which are the large, diverging, sinuous prefrontals (*p.f*); the frontal is here subconvex above and carinate below.

Here the palatines (*pa*) are cut through both in their upper and lower regions, and the space between the right and left lower laminæ is the postnasal channel (*i. n*). The maxillary (*mx*) is lowering down towards the lacrymal bone, and is strongly buttressed by the palatines.

Section 8.—A little further back (fig. 8) the frontal (*f*) is twice as wide, and has acquired a tubercular ridge; its sides turn up and carry the prefrontals (*p.f*) on them; it is still slightly carinate below; the prefrontals are now one third less. The nasal channel (*i. n*) is now at its most contracted part, and the palatines (*pa*) at their steepest and widest middle part. The maxillaries (*mx*) are of the same shape as in the last section.

Section 9.—The prefrontals have now become still narrower, and the frontal broader (fig. 9, *p.f*, *f*); the latter has lost its lower keel; and the crest above is a mass of tubercles. The palatines (*pa*) are separated both from the orbital septum (presphenoid, *p.s*) and from the maxillaries (*mx*).

Section 10.—In this section the jugal and jugal processes of the maxillary are not retained, but the roof-bones are shown *in situ*. This slice is through the common optic passage (fig. 10, II) and through the hinder part of the frontal (*f*), where the tubercles crowd between the fenestra and the coronoid suture (see Plate XVI. fig. 3). The thick-crested frontal (*f*) is very solid at this part; and at its edges it carries a new pair of bones, viz. the postorbitals (*pt. o*). As in the last, the valley is shallower and the skull-roof wider. Here the pterygoids (*pg*) are in section, close in front of the transpalatines (see Plate XVI. fig. 2, *t.pa*).

Section 11.—This is behind the orbits and through the alisphenoid and basisphenoid (fig. 11, *al.s*, *b.s*); and here the second single roof-bone, the "interparietal" (*i.p*), is cut through, close behind the coronoid suture. Here we see by this and the last sections that the cranial cavity is much foreshortened the last contained the fore end of that space; and this part of the cavity is covered by a production of the parietals. This middle bone is very solid; its sides are now shelving; and it lies directly on the dura mater. The postorbitals (*pt.o*) also are shelving, are crested at their outer edge, and then run downwards as a thick facial plate.

Section 12.—In this section (fig. 12) the roof-bone (*i.p*) does not rest on the dura mater, but is separated from it by a considerable space; its crest is higher; and its sides are thin, and do not meet the thin hind part of the postorbital (*pt.o*), which is cut through close in front of the ascending process of the jugal (Plate XVI. fig. 1, *pt.o*, *j*).

Section 13.—This section (Plate XVII. fig. 5) is through the large deep temporal spaces and the fore part of the ear-capsule. The roof is partly membranous; where it is covered in above it is not by investing bone but by the bottom of a high wall growing from the *endocranial roof*, or supraoccipital (*s.o*); the roof-bone is another crest on the top of that, a long distance from the cranial cavity. This latter part is thickened

above and below and winged at the middle; it is the high interparietal crest (*i.p*) (see also fig. 1). Bounding the temporal space, right and left, is the crest of the squamosal (*sq*), which rests on the supratemporal (*s.t*), forking over it; the pedicle of the quadrate (*pd*) is here cut across.

Section 14.—Both crests are now very high (Plate XVII. fig. 6); and the interparietal (*i.p*) is thickest above, and tuberculate both there and in the middle; the outer bones are not figured.

Section 15.—Here the section of the crest (Plate XVII. fig. 7, *i.p*) is very similar to the last, and the squamosal (*sq*) has the form it showed in fig. 5; the supratemporal (*s.t*) is here cut through in its hinder part.

The Postoral (Visceral) Arches.

A preoral arch, the ethmo-palatine, has already been described (see Plate XVII. fig. 3, and Plate XVIII. figs. 6 and 6*a*, *pa*); that is a mere rudiment. Between that cartilage and the quadrate bone there is no endoskeletal structure; for the "epipterygoid" is suppressed. Behind the mouth two large and one lesser arches are found. The pier of the mandibular arch or quadrate (Plates XVI. and XVII., *q*) is one third the length of the mandibular ramus; its proper pedicle (*pd*) is free, semielliptical, and unossified at its end; the outer process (*ot.p*) is in a line with the shaft of the bone, and is scooped above, where the two temporal bones (*sq*, *s.t*) rest upon it; that articulation has considerable mobility. This bone has a narrow waist and widened ends; the lower part ends in a condyle (*q. c*) like that of the cervical vertebra of a bird; in the axial direction it is convex; crosswise it is hollow or saddle-shaped. The articular surface of the mandible (Plate XVI. fig. 1, and Plate XVII. fig. 1) is concave lengthwise, and convex across. The proximal part of the lower jaw is ossified as the "articulare," and then runs to the chin as an undiminished Meckelian cartilage, partly hidden by the splenial (Pl. XVII. fig. 1, *ar*, *mk*, *sp*).

The hyoid arch is in four parts on each side, roughly answering to the pharyngo-, epi-, cerato-, and hypohyal of a normal branchial arch, besides a huge glosso- or basihyal, which itself is subdivided (Plates XVI. and XVII.).

The topmost element, or mediostapedial (*m.st*), is confluent with the oval stapedial plate (*st*); it is a very slender rod, which passes downwards and outwards. Where the bone ceases there the extra-stapedial region begins; but any segmentation of the cartilage which may have existed is gone.

The extrastapedial (Plate XVI. fig. 7, *e.st*) is a large tongue of cartilage attached to the *inner* side of the quadrate behind, in its *normal ichthyic* position; for there is no drum-cavity in this type, and therefore the extrastapedial does not ride over the edge of the quadrate, as in those types which have an ear-drum. There is a fenestra (*e.st.f*) in the proximal part of the cartilage; and above this space the thickened inner edge of the

cartilage passes upwards as a short suprastapedial (*s.st*); this is finished above by an enlarging ligament, which is inserted in the inner face of the quadrate, close to the top.

The ceratohyals (Plate XVI. fig. 6, *c.hy*) are long, slender, sigmoid cartilages, end in a point above, and are attached by ligament to the skull; they are scarcely as large as the columella. The hypohyals (*h.hy*) are segmented off from the ceratohyals, are one third as long, one third thicker, and ossified, except at their extremities. These articulate by their narrow end with the basal piece at the fore part of its cartilaginous end, which grows backwards as an unsegmented basibranchial (*b.br*). The main rod, or basihyal, is as long as the whole basicranial axis of the same individual—from the end of the snout to the occipital hinge. Its fore end, for one eighth of its length, is unossified and segmented off (*b.hy*^{1}); the rest is a very even cylinder of bone, nearly as thick as the "waist" of the quadrate; it becomes somewhat slenderer in front. Loosely attached to the basibranchial end of the median piece are two arcuate ossified rods, bulbous at their soft end below, and rounded at their smaller upper end; they are the ceratobranchials (*c.br*) (thyrohyals); they are as long as, but thicker than, the ceratohyals.

Skull of a newly-hatched Chameleon (*Chamæleo vulgaris*).

(Total length $1\frac{1}{2}$ inch, head $\frac{1}{4}$ inch, head and body $\frac{3}{4}$ inch, tail $\frac{3}{4}$ inch.)

This skull is the counterpart of that of *Zootoca vivipara*, described in my paper on the skull of the "Lacertilia" (Phil. Trans. 1879, plate 41, pp. 630–634); the length of those young lizards was nearly the same as that of the young Chameleon, viz. $1\frac{1}{3}$ inch. I shall throughout this part of my description compare these two skulls together.

That which strikes the eye at first in the skull of the young Chameleon is its likeness to the skull of a young Mammal; for now the cranial cavity is very large and swelling, and contains a relatively large brain.

The Investing Bones of the Young Chameleon's Skull.

I know of no skull whatever in which the roof-bones undergo so great a transformation as in this. The single frontal of the adult is seen to have two rudiments in the young (Plate XV. fig. 3, *f*); these are, even now, mainly in front of the cranial cavity, which becomes very narrow over the orbito-sphenoidal region. Thus only one third of each bone lies over the actual cavity, which contains the fore end of the hemispheres and the olfactory bulbs; the rest is due to the size, *at this time*, of the orbital rim; this is a large lunate tract, convex above and concave below.

Each frontal bone (fig. 3, *f*) is notched in front; the inner spike bounding the notch is longer than the outer, and runs up to the nasals and nasal process of the azygous premaxillary (*n*, *n.px*). The outer spike of the frontal runs, for a short distance, between the prefrontal and the nasal roof (*al.sp*). The supracranial part of each bone dips to

form its moiety of the roof, which is concave in its fore part; the frontal suture is irregular; and the hinder edge of the two bones forms a margin to the great fontanelle (*fo*). Each bone also is hooked postero-laterally, where the postorbital (*pt.o*) clamps it; and the hook turns inwards some distance over the side of the fontanelle: this part is thick; the inner part is thin and scale-like. The remaining three fourths of the large bulging fontanelle is enclosed by a very narrow bar of bone on each side, each bone having both outer and inner outgrowths; these bars are the parietals (*p*). Each bar is curved, fitting to the side of the swelling membrano-cranium; in front they are wedged in between the hinder part of the frontals and postorbitals (*p.to*); behind, they meet each other at a moderate distance beyond the cranial cavity. Outside, each bone at its middle sends outwards and forwards a small spur; the top of the squamosal (*sq*) fits on to the angle thus formed.

The somewhat dense parietal bones are developing a thin ragged tract of bone from their inner edge; behind, they are united by a growth of this kind—a tongue-shaped tract, which runs forwards along two fifths of the sagittal line. Over the hind brain (Plate XV. figs. 1, 3) this tract is already crested; it is the beginning of the huge interparietal of the adult (Plates XVI., XVII., & XVIII., *i.p*). Thus this band of new bone conjugates the primary paired parietals (*p*) into one tract. Afterwards, when the postorbitals and squamosals meet over the temporal region, the parietals up to the external spike against which the squamosal rests (Plates XV. &. XVI. figs. 1 and 3, *p*, *sq*) are absorbed, and the hinder part, becoming distinct from the huge interparietal above, is ankylosed to the top of the squamosal below; a trace, however, of the suture can be seen in the adult (Plate XVI. fig. 1, *p*, *sq*).

Thus the single *filial* interparietal not only stops the growth of the two *parental* parietals, but, like a lusty "sucker," draws half their life out of them, and carries them up to a marvellous distance from their original position on the sides of the hind cranium.

Notwithstanding the rapidly-growing frontals, parietals, and interparietals, the roof is uncovered over four fifths of its extent, as a large subcircular fontanelle split up in its hinder two fifths. The marginal bones of the hind skull are so placed as to enclose a lower temporal space (*l. t. s*), which is narrow as seen from above (fig. 3), and suboval, widest above, as seen from the side. Still the width of the skull is considerably increased by this outer basketwork of bones, which is finished above by the parietals and interparietal. The postorbital (*pt.o*) is the broadest of these bones, and not only forms a third of the orbital rim, but also sends backwards one broad process from its upper part to bind the fore end of the parietal, and another larger and sharper snag, which overlaps the jugal (zygomatic) process of the squamosal (*sq*). Its antero-superior process runs over the orbit, but does not, now, meet the prefrontal (*p.f*); a large tract of the frontal intervenes (figs. 1 and 3, *pt.o*, *f*, *p.f*).

The junction of the postorbital with the frontal and parietal is by a broad foot-shaped expansion (fig. 3), with a sinuous edge growing into the frontal and grown into by it.

The squamosal (*sq*) forms the hinder and lower boundary of the temporal enclosure; its hinder snag runs up and binds on the outer snag of the parietal; its jugal process runs forwards inside the lower process of the postorbital; its body runs downwards and forwards, and rests upon the otic process of the quadrate, where there is a proper (flat) joint with a cartilaginous facet. This bone stands over the front and outside of the quadrate head; but inside and somewhat behind there is another and smaller bone (figs. 1, 4, and 6, *s.t*): this is the very constant Lacertilian supratemporal, which is jammed in between the opisthotic (parotic) region and the squamosal. The junction of the postorbital and squamosal, below the lower temporal space, is lost in the adult (Plate XVI. fig. 1), these bones meeting higher up; thus the enclosed space is then between these bones (with the small parietal added) on the outside and the great interparietal crest on the inside. In front, over the olfactory sacs, we have the two small nasals (fig. 3, *n*) separated from each other by the top of the nasal process of the premaxillary (*n.px*).

Outside and behind these are the large ear-shaped prefrontals (*p.f*), which are both anteorbital and supraorbital in position; their pointed hind part binds against the narrow end of the frontals, whilst their broad fore end protects the nasal wall.

The infero-lateral bones have their fore part finished into an arch by the club-shaped body of the premaxillary (*px*): this (fig. 3) is free above; but the maxillaries nearly meet below it (fig. 2). The latter bones (*mx*) rise high behind the alinasal ring to meet the prefrontal, and then drop suddenly beneath the small unguiform lacrymal (*l*) and the styloid fore part of the jugal (*j*); the latter bone is falciform, and finishes the orbit below and behind, running up to bind over the long arcuate descending process of the postorbital.

The submucous bones of the palate (fig. 2) are in three pairs, with an odd one in front: this is the vomer (*v*), a lanceolate ossicle, hollow above and below, and broader in the latter region than above; it is wedged in between the fore end of the palatine plates of the maxillaries in front, and behind the ascending submesial spur of the palatines behind. These bones (*pa*) have a falcate outer region below, with the convexity inside; here each bone rises and is arched, meets its fellow, and sends forwards a sharp ethmo-palatine spur, as in Birds.

The pterygoid and transpalatines (*pg, t.pa*) have much of their adult shape—the former ending by a point under the palatine, but only reaching to one third of that bone, two thirds of its length from the vomer, and not touching it, as in most "Carinate" birds and *Hatteria*. The investing bones of the mandible (fig. 6) are quite similar to those of the adult; this part only increases in size after hatching; the relative proportion of its elements remains much the same throughout life.

The Endocranium of the Young Chameleon.

The most striking things in this structure are the large, tumid, membranocranium and the massiveness of the auditory capsules (Plate XV. figs. 1, 3, 4, 7, & 8). In front, up to the optic passages (II), the chondrocranium is merely an imperfect wall of cartilage, confluent with the twin capsules of the nose.

The occipital arch is well developed both above and below; on its sides it is cramped and narrowed by the ear-capsules; the condyle (*oc. c*) is suboval transversely; the bony centres (*e.o*, *b.o*) barely reach it as yet. The foramen magnum (*f. m*) is very large, and fairly at the end of the skull. The bones are well bordered by cartilage, all save a space in front of the basal plate (fig. 2), where the floor is membranous; that bone, the basioccipital (*b.o*) is a large, thin, U-shaped plate, the horns of which enclose all but the fore margin of the large suboval posterior basicranial fontanelle (*p. b. c. f*). A wide tract of cartilage separates this threshhold piece from the side plates—the exoccipitals (*e.o*) behind, and the opisthotics (*op*) further forwards.

The exoccipitals (fig. 4, *e.o*) are narrow above and dilated below. The 9th and 10th nerves (IX, X) pass between them and the opisthotics (*op*); and the 12th (XII) pierces the bone.

There is a considerable tract of cartilage between the exoccipitals and the crown of the arch, the superoccipital (*s.o*); this is to a considerable extent filled in by an extension, backwards, of the epiotic (*ep*), a shell of bone of the form of a quadrant (fig. 7, *ep*). The supraoccipital has already sent upwards a squarish crest, rugged above; this ends in a rounded tongue of cartilage (fig. 8), which lies directly beneath the tongue-shaped interparietal tract (fig. 4, *i.p*); afterwards, as I have shown, this will be a high thin crest underpropping the high thin crest of the interparietal (Plates XVI. & XVII.).

The outer view (fig. 7) shows the great triradiate synchondrosis between the three periotic osseous tracts. These are very unequal in size: the prootic (*pr.o*) is the largest, and is twice the size of the opisthotic (*op*), which again is twice the size of the epiotic. The ampullæ of the anterior and horizontal canals, and part of their arches, are contained in the prootic. The ampulla of the posterior and the end of the horizontal canals lie in the opisthotic; and the meeting part of the anterior and posterior is in the epiotic (Plate XVI. *a. s. c*, *h. s. c*, *p. s. c*, *pr.o*, *op*, *ep*).

Below the arch of the horizontal canal, at the postero-inferor edge of the prootic, there is an oval membranous space, the fenestra ovalis, filled by the stapedial end of the columella (fig. 7, *pr.o*, *f. o*, *st*); the postero-inferior margin of the fenestra ovalis is enclosed by cartilage, which will be ossified by the opisthotic, which constantly forms the hinder edge of this space. The basisphenoid (*b.s*) is separated from the antero-inferior corner of the prootic by a cartilaginous tract, and also, above, from the horns of the basioccipital (fig. 8, *b.s*, *b.o*, *pr.o*). But below (fig. 2) the basisphenoid sends back sharp horns of bone, which fasten on the ends of the broad horns

of the U-shaped basioccipital. The hinder margin of the basisphenoid is lunate, not semielliptical, like the fore margin of the basioccipital; its axial length is only half as great as that of the hinder bone. The basisphenoid would be a triangular wedge (for it ends in an almost pointed process in front); but it gives off at the middle on each side a wing of bone, dilated and cartilaginous externally. These wings are the basi-pterygoid processes (*b.pg*), whose direction is downwards, outwards, and forwards.

The openings for the trigeminal nerves (v) are surrounded by membrane everywhere except a small tract below and behind; for here, in the alisphenoidal region, the membranocranium (*al.s.f*) extends over the highest part of the head, and down on each side to the base (fig. 7). The alisphenoid (*al.s*) is a feeble sigmoid bar in front of this space; it is continuous with the basal cartilage, between the optic passage and the foramen ovale (II, V), and with the orbito-sphenoid (*o.s*) above the common optic passage. The lower half is ossifying, and is arched backwards; the upper half, which only reaches up to the most tumid part of the membranocranium, is soft, and bends forwards. Between this feeble rudiment of the "ala magna" and the orbito-sphenoidal lamina there is a deepish triangular notch.

The chondrocranium in front of the ali- and basisphenoid is quite unossified; in front of the great common optic passage (II) there is an oblique presphenoidal band (*p.s*) running downwards and forwards to the trabecular base. In front of this there is a large oblong interorbital fenestra (*i.o.f*), not *notch*, as in *Lacerta*.

The thick trabecular base below and the thin lamina above this fenestra are about equal in depth. From the upper part there proceed a pair of narrow orbito-sphenoidal wings (*o.s*); these soon become almost obsolete, and then widen in the ethmoidal region, where they are pierced by the olfactory nerves (I) and lie over the orbito-nasals (V^1). The perpendicular ethmoid becomes a low middle wall, passing into the septum nasi (figs. 7 & 8), which divides the flat, but tumid, 4-celled nasal labyrinth, with its annular outworks (*al.sp*, *al.n*). From the postero-inferior face of the capsule there is a small semioval cartilage projecting; this is the ethmo-palatine (*e.pa*)

The Postoral Arches in the Young Chameleon.

The whole articular head (otic process) and the pedicle and the base of the quadrate is still soft (fig 1, *ot.p*, *pd*, *q. c*); and part of the free mandible is unossified nearly to the condyle, not being covered, as yet, by the articulare (fig. 6, *mk*, *ar*). The long glosso- or basihyal rod, with its small terminal segment (fig. 8, *c.br*, *b.hy*, $b.hy^1$), is unossified; also the ceratohyals (*c.hy*) and hypohyals (*h.hy*). The thyrohyals, or 1st cerato-branchials (*c.br*), are well ossified already.

The long azygous rod is not quite so long, relatively, as in the adult; it only reaches, if measured by the basis cranii, from the occipital condyle to the middle of the septum nasi.

The columella (figs. 4 & 7, *co*, *st*) has nothing to distinguish it from a feebly developed *ichthyic* epihyal or hyo-mandibular, except its fusion proximally with the fenestral operculum of the auditory sac (stapes).

Its direction is downwards; and it is bent outwards; but it lies in the proper position of an ichthyic epihyal, a position soon attained in fishes, where the postoral arches are arranged *telescopically*; that is, the lesser hinder arches pass within the larger fore arches. The more directly *outward* direction of the epihyal, with a forward curve round the quadrate, first shows itself in the Anura, where the tympanum is well developed; here, in the Chameleon, the closing-up of this cavity is correlated with the retention of an ichthyic position of this element.

I shall compare the skull of the young and adult, and both with the typical Lacertian skull, when I have described the next type—one not so non-typical as the common kind.

Skull of Chamæleo pumilus, *Adult Male.*

Morphologically, the skull of this species comes in halfway between that of the young and the adult in the last species; indeed, it has supplied exactly the link I wanted between those stages to enable me to interpret the strangely transformed roof-bones in the Common Chameleon.

The supercranial valley (Plate XIX. fig. 3) is not so definite in this dwarf species, nor is the interparietal crest so high; moreover that crest is composed of only one, not three, pieces.

All the exposed parts of the investing bones are covered with a growth of tubercles both really and relatively much larger than in the Common Chameleon. They are large clear beads, or "guttæ," of bony substance; and these run in rows along the ridges and in lines parallel with the ridges,—a structure better to be understood by reference to the skull itself, or the figures of it, than by any description.

The modifications seen in this skull as compared with the last are tendencies towards, (or survivals of) what is typical; thus this is an excellent connecting link between the normal Lizards and the abnormal Chameleon.

Investing Bones of the Skull of the Dwarf Chameleon.

The frontals (Plate XIX. figs. 1 & 3 (*f*) are completely ankylosed together; and the fontanelle (*fo*) is some distance in front of the coronal suture. This double bone is square (roughly), with a wedge-like prolongation in front; thus its anterior margins are oblique and notched; its posterior margin is emarginate, the parietal wedging in behind. As in the young of the last kind, the frontal has a considerable *orbital* tract (figs. 1 & 3, *f*), as the prefrontals and postorbitals (*p.f*, *pt.o*) are far apart. The orbital regions of the frontal are raised considerably at their edge; and this is strongly beaded.

The "valley" has a pair of submesial rows of bosses, and an irregular crop along the middle; the sutures all round the bone are strongly but irregularly toothed.

There is only one parietal bone (*p*, *i.p*); this is quite distinct from the squamosals (*sq*), postero-laterally. The temporal vacuity (figs. 1, 3, & 4, *l. t. s*) is a large oval space, with an oblique emargination in front, formed by the hinder edge of the postorbital (*pt.o*). But in the adult skull of the Common kind (Plates XVI. and XVII.) the temporal space is between the interparietal within and the postorbital, squamosal, and parietal outside. I question whether the parietals in this species ever had a distinct interparietal; at any rate it only had a temporary existence. This relatively large, knobbed slab of bone has an arched lateral outline, and projects backwards half its length beyond the foramen magnum (*f. m*); it has a lateral pair and a sublateral pair of rows of tubercles, and a median row more compressed and less distinct from each other.

Only the fore margin of the parietal rests directly upon the membranocranium (*dura mater*); the main part, even over the skull, sends downwards a median keel, which rests upon the top of the endoskeletal crest (supraoccipital, fig. 5, *s.o*).

In this species the postorbital (*pt.o*) just touches the foremost outer tubercle of the parietal (fig. 3); from the middle of the latter (fig. 1, *p*, *sq*) a descending process bends down upon the fore part of the top of the squamosal: this is where ankylosis has taken place in the adult of the Common kind; and this outer part corresponds with the aborted *lateral* parietal of that species, which articulates with the great outer parietal crest behind. Here there is no such joint; it is all one bony tract. The postcranial part of the common parietal bone in this species is hollow and smooth below (figs. 2 & 4, *p*); the keel is continued some distance behind the supraoccipital.

The fore part of the roof is formed of two pairs of bones; and these only partially cover it; they are the nasals and prefrontals (fig. 3, *n*, *p.f*) The nasals are united by a suture and are narrow behind, where they bind on to the fore spur of the frontal, and broad in front, where they articulate with the ascending part of the maxillaries (*mx*), not with the nasal process of the premaxillary, which does not ascend so far in this kind. For two thirds of their length they have the supernasal fontanelle (*s.n.f*) outside them; this is pyriform, and ends narrow behind, between the end of the frontal and the top of the prefrontal.

This latter bone (*p.f*) is large, and covered above with large crowded bosses; it has a short anterior suture with the nasal, in front of the membranous space, and an oblique crescentic suture with the anterior margin of the frontal. It makes part of the rough ornamentation of the fore face, above the maxillary (fig. 1, *p.f*, *mx*), and then, ascending, has both an anteorbital and a superorbital position, forming by its inner face the anterior fourth of the eye-socket. The postorbital (*pt.o*) is an arcuate bone, margining nearly a fourth of the eye-socket supero-posteriorly, and fixing itself to the contiguous bones by two pairs of snags. The upper two of these form the two rounded teeth of a short suture with the frontal (figs. 1 & 3); the two lower processes are larger, more divaricated, and oblique; the front spur descends, and is fastened inside

the top of the jugal (*j*); the hinder spur obliquely overlaps the jugal process of the squamosal. The latter bone (*sq*) finishes the oval temporal space behind and below, and runs upwards to prop the parietal at its outer angle, the angle binding on the front of the squamosal. Below, the squamosal helps the supratemporal (*s.t*) to form a swinging point to the quadratum (*q*).

The supratemporal (*s.t*) is a smaller bone; is nowhere subcutaneous; so it has no bony warts on it like the exposed bones. It is tightly jammed in between the squamosal and the parotic wing (fig. 4, *sq*, *s.t*, *op*).

The bones of the lower margin are strongly verrucose at their upper margin; but the skin of the upper lip thickens lower down, and the bone becomes smooth. The premaxillary is like a short round-headed nail; in its upper aspect it looks twice the size it does in its lower; in that aspect, however, it is seen to separate the right and left maxillaries from each other. It is not half so long, relatively, as in the Common species (Plate XIX. fig. 3, and Plate XVI. fig. 3, *px*): there we find it running up between the maxillaries, prefrontals, and nasals; here it only half separates the maxillaries on their upper face, and these bones keep the prefrontals from the mid line.

The maxillaries (*mx*) are warty both in front of and behiud the nasal aperture (*e. n*, *al.n*). They are then notched above, for the small "os unguis" (*l*), and then narrow steadily as they run back under the jugal.

That bone (*j*) articulates with the lacrymal in front, with the maxillary below, and then ascends to bind over the descending process of the postorbital (*pt.o*). The jugal forms more than a fourth of the orbital rim; it is a solid falciform bone, covered outside with a row of bosses that form the ornament of the orbital rim; and it has another boss at the end of the maxillary.

On the whole, the membrane bones of this species are like those of the Common Chameleon; but there is an additional bone, which brings it nearer to the typical Lacertilian: this is the parasphenoid.

This bone (fig. 2, *pa.s*) is a small style, confluent behind with the basisphenoid (*b.s*); it is quite similar to what we find in Lizards generally.

The vomer (*v*) is notched at both ends, and may have arisen from two centres, as in many Birds; but the azygous vomer of the young of the Common species suggests for this also a single centre.

The palatines (fig. 2, *pa*) are very similar to those of the last kind; they have a narrow ascending, and a wide horizontal region. The former lies over the nasal groove; and the latter encloses it, right and left.

The pterygoids (*pg*) and transpalatines (*t.pa*) are very similar to those of *C. vulgaris*. The former are still shorter, relatively, and are attached behind to the quadrate by a ligamentous tract.

The splints of the mandible (fig. 1) are also quite similar to those of the Common kind; in the figure the splenial (*sp*) is indicated in this outer view by dotted lines.

The Endocranium of the Dwarf Chameleon.

The endocranium, on the whole, is quite like that of the last kind. The occipital condyle (*oc. c*) is large and projecting; it is suboval, with its long diameter transverse. The basioccipital (*b.o*) is hollow beneath, projects externally, and is widest in front. The exoccipitals (*e.o*) are confluent with the opisthotics (*op*); but the nerve-passages (IX, X) are their landmarks. So, also, the supraoccipital (*s.o*) is confluent with the epiotic; it sends up a much smaller crest to meet the less-modified interparietal region. The foramen magnum (fig. 4, *f.m*) is pyriform; it is much elongated upwards. The parotic processes (*op*) are much shorter than in *C. vulgaris*; the posterior canal (*p. s. c*) is seen to be largely imbedded in the opisthotic; its upper part, which passes into the tube of the anterior canal (fig. 5, *a. s. c*, *p. s. c*), lies in the epiotic (*ep*).

The prootic (fig. 5, *pr.o*) contains most of the anterior and horizontal canals (*h. s. c*); and the side view shows the whole occipito-otic region to be very limited, and shaped like an hourglass.

A lanceolate space, nearly as large as the combined occipital and periotic regions, lies in front of them, naked of cartilage and of bone (*al.s.f*). The oblique band of cartilage passing in front of this "fenestra," and leaning forwards, is the alisphenoid (*al.s*); two thirds of its lower half is ossified as a shaft-bone; below it is continuous with the basisphenoid, and in front, at the middle, with the orbito- and presphenoid. The roof-bone (*i.p*) rests upon its somewhat dilated top. The basisphenoid (figs. 2, 4, & 5, *b.s*) is a large two-winged bone, narrowing from before backwards, crescentically emarginate behind, and bifid in front; it has large, dilated, descending basipterygoid wings (*b.pg*), and above is scooped for the pituitary body. This bone articulates with the basioccipital behind, the prootics at its sides, and the small parasphenoid in front.

There is a triangular notch between the ali- and orbito-sphenoids, a large common optic passage (II), and an oblique pyriform interorbital fenestra (*i.o.f*), as in the Common kind and in many other of the Lacertiiia. The orbito-sphenoid wings (*o.s*) are not large; the common orbito-nasal septum (*p.s*, *p. e*) rapidly lessens forwards; there is no definite bony tract in front of the optic passage.

The Inferior Arches of the Dwarf Chameleon.

These parts are very similar to what I have described in the Common species. The quadrate (*q*) has a definite otic process and pedicle (*ot.p*, *pd*); the articulare (*ar*) is well ossified; and the postmandibular arches, like the mandible itself, are a mere miniature of what is to be seen in the Common kind.

Comparison *of the* Skull *of the* Chameleon *with that of other* Lacertilia, *especially the typical* Lacerta.

Leaving out the Chameleon, the types whose skulls are most unlike are *Lacerta* and

Hatteria; yet that of the latter (see Günther, Phil. Trans. 1867, pl. 1) is less aberrant in many things than that of the Chameleon. The continuity of the stapes with the hyoid arch is not a unique character; that which is unique is the binding of the cheek to the quadrate by a quadrato-jugal, a character which *Hatteria* has in common with Chelonians, Crocodilians, and Birds. That type, however, has the vomers large and distinct, and an epipterygoid the largest seen in any Reptile.

The most instructive skull for comparison with that of the Common Chameleon belongs to a Mexican Iguanian Lizard, viz. *Læmanctus longipes*. Its size is about the same; and it is exquisitely ornate, and possesses a very large interparietal crest. Yet in nearly every thing this remarkable skull is normal, except in the development of the crest. As in the Chameleon, the frontals are ankylosed together; but the fontanelle, although bounded by the frontal, lies on the edge of the parietal. That bone sends outwards and backwards the normal "horns," that are articulated to the parotics, supratemporals, and squamosals in the normal manner; but it has also a large, flat, vertical crest, formed by the gradual narrowing of the parietal bone from before backwards; and this crest, keeping very nearly the line of the general gentle rise of the top of the head, extends far backwards beyond the endocranium. But the supraoccipital does not rise to meet it; so that the height of the head behind is much less than in the Chameleon.

In the young of the Common Chameleon and in the adult Dwarf kind, we saw the parietals as one bone: in the former a median forward outgrowth, belonging to the pair of primary parietals, had yoked them together; in the latter the three elements were seen to be all lost in one large, crested, arched, tuberculate slab of bone.

In *Læmanctus*, undoubtedly, the primary bands that formed the beginning of the parietal bones rapidly developed a common median outgrowth, that shot up into the large lateral crest; but I question if, at any time, there were three distinct bones.

In comparing the skull of the Chamæleon with that of *Lacerta* (see Phil. Trans. 1879, plate 42), I shall leave out of account the supernumerary bones that are seen over the eyes and temples in that typical form, as well as in some others, such as *Mocoa* (a "Scincoid").

The Common Chameleon differs from the typical Lizards—

a. In the investing bones:

1. Their highly ornate character.

2. The *frontals* are fused together * and contain the fontanelle.

3. The *parietals* are broken up into three bones, two parietals and an interparietal; but the former are abortively developed, articulate with *the end* of the interparietal crest, and are ankylosed with the squamosals.

4. The *prefrontals* and *postorbitals* are articulated with each other over the orbit, thus excluding the frontal from the outer ring.

* Lizards are very variable as to this character.

5. The *prefrontals* articulate with the nasal process of the *premaxillary*, in front of and below the nasals.

6. The *nasals* are very feebly developed, and fail to cover their own region, leaving a membranous fenestra between themselves and the prefrontal, right and left.

7. The *premaxillary* is a feeble edentulous wedge of bone, almost excluded from the fore palate.

8. The adult of the Dwarf and the young of the Common Chameleon have a normal temporal space; the postorbital and squamosal unite below, and form the lower boundary, which is enclosed by the parietal above. In Lizards, generally, the parietal forms the upper (inner) boundary of the large temporal space, which is bounded by the postorbital and squamosal below or outside; in many cases the supratemporal helps the parietal "horn" to enclose this space above; but in *Iguana tuberculata* the supratemporal fits inside the horn. In the adult Common Chameleon the *paired* parietal, being aborted in front and ankylosed to the top of the squamosal behind, helps to form the lower or outer boundary of the temporal space, each inner being entirely formed by the large individuated interparietal. In Lizards, generally, each parietal "horn," passing outwards and backwards to the postero-external angle of the skull, forms a *post-temporal* space between the hind skull (occipito-auditory region) and itself. In "Cyclodonts" (*Trachydosaurus*) the huge, arcuate, parietal horn comes so close, in front, to the dilated postorbital, as almost to obliterate the temporal space; for above there is merely a small tract of membrane, which finishes the temporal roof. Thus there is a great open space behind the horn, and this skull approximates to that of the Green Turtle (*Chelone viridis*). In the Chameleon the two spaces (temporal and posttemporal) are about equally divided by the parieto-squamosal bar (Plate XVI. figs. 3 & 4), which rises over and spans this great tract, not seeming to divide it into two distinct spaces, as in the Lizards, generally, where the posttemporal space is small and lanceolate.

9. The absence of a parasphenoid in the Common kind is a rare character; I have only missed it, in other Lizards, in *Trachydosaurus rugosus*.

10. The single vomer is very remarkable; and this condition is not due to fusion of the centres; it is azygous in the embryo, as in the Chelonia.

11. The absence of the septo-maxillaries is a correlate of the singleness of the vomer, and of the peculiar position of the *nasal glands*, above and behind the nasal roof.

12. I consider the intense fusion of the teeth with the jaw-bone, and the absence of *pterygoid teeth*, to be worth mentioning, as well as the absence of teeth on the premaxillary.

13. The peculiar depth and great size of the pterygoid behind, and its shortness, ending in front of the quadrate, and united to it by ligament; in the Lizards generally the pterygoid is thin and falcate behind, and binds strongly inside the quadrate.

b. Endocranial modifications in the Chameleon's skull:

14. The huge high supraoccipital crest.

15. The absence of the rudiment of a cochlea, and of the fenestra rotunda.

16. A very small and simple alisphenoid, instead of the normal basketwork of cartilage and bone.

17. The orbito-nasal septum agrees with many in having the membranous space enclosed (as a fenestra), and not open (as a notch), as in *Lacerta*.

18. There is no cranio-facial fenestra between the perpendicular ethmoid and the septum nasi.

19. The ali-ethmoidal cartilages are notched for the nasal glands; and there is no fenestra, right and left, in the ali-septal roof.

20. There is no free or confluent labial cartilage running between the snout and the upper surface of the vomer, as in *Lacerta*; but the ali-nasal annulus is much more evidently a confluent (valvular) labial, corresponding to the *outer* upper labial of the metamorphosed Frog and Toad.

c. Modifications of visceral arches in the Chamæleon:

21. There is no epipterygoid—a part which exists in all other Lacertilia known to me, is largest in *Hatteria*, and is present in all known Chelonia.

22. The pedicle of the quadrate is a very distinct process from the otic process; it is much broader than in the Chelonia, but, as in them, has the tip unossified.

23. The columella keeps within the quadrate, has not a bifurcated supra-stapedial process, has no infrastapedial, and is not functional; there is no cavum tympani. The hyo-branchial apparatus is very unlike that of the typical Lizard.

24. The hypohyals are quite distinct from the basal bar and from the ceratohyals; the latter are not dilated below; both hypo- and ceratohyals are (normally) unossified.

25. The basi- or glossohyal is as long as the skull, is highly ossified, and has a small unossified segment at its fore end and a non-segmented basibranchial process behind.

26. The ceratobranchials are well ossified; they have no upper or epibranchial segment, as in *Lacerta*; there are no hypobranchial processes, or thyro-hyals, behind and within them proceeding from the basal bar, which is narrow and rounded at the end.

Comparison *of the* Chameleon's Skull *with that of the* Amphibia *and the* Chelonia.

The skull of the Chameleon, in differing so much from that of the other Lacertilia, does not, at the same time, approximate to that of other types below, aside of, or above its own family.

The Chameleon's skull resembles that of those Anura which have a columella but no "cavum tympani," and also agrees with them in having neither a cochlea nor a fenestra rotunda. It agrees with the Chelonians in having a single vomer and no septo-maxillaries, and in having a crested supraoccipital, and with the Ophidia and Crocodilia in having no epipterygoid.

With many Birds the Chameleon agrees in the position of the nasal glands, which is a correlate of the azygous vomer, and the suppressed septo-maxillaries: yet many Birds have two vomers originally; the Chameleon has only one from the first.

In mere form, the head of the Chameleon resembles that of many high-skulled Teleostean Fishes; but the height is obtained by very different methods in the two types of skull.

In conclusion, it is self-evident that the Chameleons are a very isolated group of Lizards. Like Snakes, they are low in certain respects, and yet in others are specialized to the utmost.

List of Abbreviations.

The Roman figures in the Plates indicate the nerves or nerve-foramina.

ag. Angular.
al.n. Alinasal.
al.s. Alisphenoid.
al.s. f. Alisphenoidal fenestra.
al.sp. Aliseptal.
ar. c. Articular condyle.
a. s. c. Anterior semicircular canal.
au. Auditory sac.
b.hy. Basihyal.
b.hy'. Additional basihyal.
b.o. Basioccipital.
b.pg. Basipterygoid.
b.s. Basiphenoid.
C^1. Fore brain.
C^2. Mid brain.
C^3. Hind brain.
c.br. Ceratobranchial.
c.hy. Ceratohyal.
co. Columella.
cr. Coronoid.
c. tr. Cornu trabeculæ.
d. Dentary.
e. n. External nostril.
e.o. Exoccipital.
ep. Epiotic.
e.pa. Ethmopalatine.
e.st. Extrastapedial.
e.st. f. Extrastapedial fenestra.
f. Frontal.
f. m. Foramen magnum.
fo. Fontanelle.
f. o. Fenestra ovalis.
h.hy. Hypohyal.
h. s. c. Horizontal semicircular canal.
i. n. Internal nostril.
i.o. f. Interorbital fenestra.
i.p. Interparietal.
i. tb. Inferior turbinal.
j. Jugal.
l. Lacrymal.
l. c. Lacrymal canal.
mk. Meckel's cartilage.
m.st. Mediostapedial.
mx. Maxillary.
n. Nasal.
n. f. Nasal floor.
n. g. Nasal gland.
n. px. Nasal process of premaxillary.

oc. c. Occipital condyle.
op. Opisthotic.
o.s. Orbitosphenoid.
ot. p. Otic process.
p. Parietal.
pa. Palatine.
pa.s. Parasphenoid.
p. b.c. f. Posterior basicranial fontanelle.
p. c. Middle ethmoid.
p.f. Prefrontal.
pg. Pterygoid.
pr.o. Prootic.
p.s. Presphenoid.
p. s. c. Posterior semicircular canal.
pt.o. Postorbital.
px. Premaxillary.
py. Pituitary space.
q. Quadrate.
s.ag. Surangular.
s. n. Septum nasi.
s.o. Superoccipital.
sp. Splenial.
sq. Squamosal.
s.st. Suprastapedial.
st. Stapes.
s.t. Supratemporal.
t.pa. Transpalatine.
v. Vomer.
vb. Vestibule.

DESCRIPTION OF THE PLATES.

PLATE XV.

Fig. 1. *Chamæleo vulgaris*: ripe young, $1\frac{1}{2}$ inch long, head $\frac{1}{4}$ inch, tail $\frac{3}{4}$. The skull, side view, $\times 13\frac{1}{3}$ diameters.
Fig. 2. The same, lower view, $\times 13\frac{1}{3}$ diam.
Fig. 3. The same, upper view, $\times 13\frac{1}{3}$ diam.
Fig. 4. The same, end view, $\times 13\frac{1}{3}$ diam.
Fig. 5. The hyo-branchial arches, upper view, $\times 13\frac{1}{3}$ diam.
Fig. 6. The mandible, inner view, $\times 13\frac{1}{3}$ diam.
Fig. 7. The endocranium, side view, $\times 13\frac{1}{3}$ diam.
Fig. 8. The same, upper view, $\times 13\frac{1}{3}$ diam.

PLATE XVI.

Fig. 1. *Chamæleo vulgaris*: adult female. The skull, side view, $\times 3\frac{3}{4}$ diam.
Fig. 2. The same, lower view, $\times 3\frac{3}{4}$ diam.
Fig. 3. The same, upper view, $\times 3\frac{3}{4}$ diam.
Fig. 4. The same, end view, $\times 3\frac{3}{4}$ diam.
Fig. 5. The same species: large male. The skull and brain *in situ*, longitudinally vertical section, $\times 3\frac{3}{4}$ diam.
Fig. 6. The same. Hyo-branchial arches, upper view, $\times 3\frac{3}{4}$ diam.
Fig. 7. The same. Quadrate bone and columella, $\times 7\frac{1}{2}$ diam.

PLATE XVII.

Chamæleo vulgaris.

Fig. 1. Large male: the skull, longitudinally vertical section, *right* side, ×3 diam.
Fig. 2. Part of *left* section of the same skull, ×$3\frac{2}{3}$ diam.
Fig. 3. Endocranium of a female, side view, ×$3\frac{3}{4}$ diam.
Fig. 4. The same, upper view, ×$3\frac{3}{4}$ diam.
Fig. 5. A smaller male: transversely vertical section of decalcified skull through fore part of ear-sac (13th section), ×$3\frac{3}{4}$ diam.
Fig. 6. Another section, through middle of ear-sac (14th section), ×$3\frac{3}{4}$ diam.
Fig. 7. Another section, through hind part of ear-sac (15th section), ×$3\frac{3}{4}$ diam.

PLATE XVIII.

Chamæleo vulgaris.

Fig. 1. Smaller male: decalcified skull (same as in Plate XVII. figs. 5–7), section in front of nose (1st section), ×$3\frac{3}{4}$ diam.
Fig. 2. The same, through nostrils (2nd section), ×$3\frac{3}{4}$ diam.
Fig. 3. The same, through nostrils further back (3rd section), ×$3\frac{3}{4}$ diam.
Fig. 4. The same, through hind part of nostrils (4th section), ×$3\frac{3}{4}$ diam.
Fig. 5. The same, through hind part of nostrils (5th section), ×$3\frac{3}{4}$ diam.
Fig. 6. The same, through middle of nasal sacs (6th section), ×$3\frac{3}{4}$ diam.
Fig. 6 A. The same object, with bones removed, ×$7\frac{1}{2}$ diam.
Fig. 7. First interorbital section (7th section), ×$3\frac{3}{4}$ diam.
Fig. 8. Second interorbital section (8th section), ×$3\frac{3}{4}$ diam.
Fig. 9. Third interorbital section (9th section), ×$3\frac{3}{4}$ diam.
Fig. 10. Fourth interorbital section (10th section) through optic nerve, ×$3\frac{3}{4}$ diam.
Fig. 11. Section made between optic and trigeminal nerves (11th section), ×$3\frac{3}{4}$ diam.
Fig. 12. Another, through foramina ovalia (12th section), ×$3\frac{3}{4}$ diam.

PLATE XIX.

Chamæleo pumilus.

Fig. 1. Adult female: the skull, side view, ×6 diam.
Fig. 2. The same, lower view, ×6 diam.
Fig. 3. The same, upper view, ×6 diam.
Fig. 4. The same, end view, ×6 diam.
Fig. 5. The same, side view of orbital and auditory regions, ×6 diam.